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No. 8

Codeine and Codeine-Porphyroxine Charts in Relation to the Origin of Opium

In continuation of the international programme of scientific research undertaken pursuant to Resolutions 159 (VII) II C and 246 F (IX), adopted by the Economic and Social Council on 3 August 1948 and 6 July 1949, the Secretary-General is now publishing the present paper, which has been prepared by the Secretariat chemists. This paper gives data on the codeine content of the United Nations samples, and presents and explains charts showing the distribution of codeine values among different producing areas, and the relation between correlated codeine and porphyroxine values and the origin of the samples of opium.

/TABLE

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CODEINE AND CODEINE-PORPHYROXINE CHARTS IN RELATION TO THE ORIGIN OF OPIUM

I. PURPOSE OF THE PAPER

1. The purpose of the present paper is to show the relation of codeine percentages, and of codeine percentages and "porphyroxine-meconidine" values when considered together, to the geographical origin of the opium samples.

2. The new codeine values, obtained on the United Nations opium samples, are first presented and discussed briefly. Then charts are given, based on all the codeine percentages and porphyroxine values obtained by the Secretariat. (Earlier codeine analyses were reported in E/CN.7/202 and porphyroxine values in E/CN.7/195 and ST/SOA/SER.K/4.)

3. The purpose is further to show clearly the great value of classifying a sample of seized opium by its codeine and porphyroxine values, correlated or considered together, as a means of determining the origin of the opium.

II. METHOD OF CODEINE ANALYSIS

4. The method used for codeine analysis was that given in document E/CN.7/202, paragraphs 7 to 13. Any reasonably accurate method for codeine could be used for charts similar to those hereafter presented, but there would have to be some adjustment of the dividing points or boundary lines if the method is changed.

III. CODEINE PERCENTAGES OF THE UNITED NATIONS SAMPLES

TABLE 1.

	China	
U.N. 37 - Received from Taiwan -	lump A	4.12
	lump B	5.15
	lump C	5.10
	lump D	4.53
	Greece	
U.N. 25 -	small loaf, a	1.25
	small loaf, b	1.04
	small loaf, c	1.23
	small loaf, e	1.26
	India	
U.N. 34 - Banaras opium		3.11
U.N. 35 - Malwa opium		3.23
U.N. 36 - Excise opium		3.03
Old Seizure of Standardized opium (redetermination)		3.02
	Iran	
U.N. 18 - Export opium		3.35
U.N. 19 - Export opium		3.22
U.N. 20 - Export opium		3.46
U.N. 21 - Export opium		3.37

/Iran (continued)

	Iran (continued)	
U.N. 47 - Fars		3.71
U.N. 48 - Isfahan		2.46
U.N. 49 - Kerman		3.14
U.N. 50 - Kermanshah		3.35
U.N. 51 - Khorassan		2.93
U.N. 52 - Nehavand		3.35
U.N. 45 - Seizure in France:		
(a) light coloured sticks (porphyroxine - 1.0)		3.39
(b) an average dark stick (porphyroxine - 8.0)		2.64
U.N. 53 - Seizure (porphyroxine - 6.2)		3.45
	Korea	
U.N. 16 - Korea No. 1 - A		1.31
No. 1 - B		1.23
(Korea No. 1 is substandard or adulterated. Lump A assayed only 4.36 percent of morphine)		
U.N. 17 - Korea No. 2		2.45
52844 - From Korea factory at close of World War (1945). (porphyroxine - 9.6)		4.22
	Laos	
U.N. 26 - Laos, Luang Prabang,	lump A	2.14
	lump B	1.93
	lump C	1.77
U.N. 27 - Laos, Xieng Khouang,	lump A	1.79
	lump B	2.41
	Turkey	
U.N. 1 - Turkey No. 1 - Aydin -	lump A	1.32
	lump B	2.12
	lump C	2.33
	lump D	1.96
	lump E	1.46
	lump F	1.61
	lump G	1.50
	lump H	1.64
U.N. 2 - Turkey No. 2 - Afyon -	lump A	2.19
	lump B	2.14
	lump C	1.67
U.N. 3 - Turkey No. 3 - Çorum -	lump A	1.21
	lump B	1.35
	lump C	2.02
	lump D	1.00
U.N. 4 - Turkey No. 4 - Çal -	lump A	1.55
	lump B	0.90
	lump C	1.20
	lump D	2.36

/Turkey (continued)

Turkey (continued)

U.N. 5 - Turkey No. 5 - Usak -	lump A	1.28
	lump B	0.78
	lump C	0.90
	lump D	0.97
U.N. 6 - Turkey No. 6 - Nallihan-	lump A	0.80
	lump B	0.92
	lump C	1.12
	lump D	1.17
	lump E	1.27
U.N. 7 - Turkey No. 7 -Merzifon-	lump A	1.45
	lump B	1.67
	lump C	1.04
	lump D	1.77
U.N. 8 - Turkey No. 8 - Burdur-	lump A	1.85
	lump B	0.94
	lump C	0.85
U.N. 9 - Turkey No. 9 - Kula -	lump A	2.32
	lump B	1.55
	lump C	1.62
	lump D	1.45
U.N. 10 - Turkey No. 10 - Sandikli -	lump A	0.84
	lump B	0.97
	lump C	1.42
U.N. 11 - Turkey No. 11 - Aksehir -	lump A	1.00
	lump B	1.77
	lump C	1.17
U.N. 12 - Turkey No. 12 - Zile -	lump A	1.56
	lump B	2.25
	lump C	3.81
	lump D	3.67
	lump E	1.65
	lump F	2.41

(Zile lump A is adulterated with cornstarch; nevertheless, it assayed 11.1% percent in morphine.)

U.N. 13 - Turkey No. 13 - Isparta -	lump A	1.37
	lump B	1.78
	lump C	0.75
U.N. 14 - Turkey No. 14 - Malatya -	lump A	3.04
	lump B	2.38
	lump C	2.99
	lump D	2.11
	lump E	2.85
U.N. 15 - Turkey No. 15 - Export opium		1.08
U.N. 29 - Exhibition - A, half loaf		2.52
B, whole loaf		2.16
U.N. 30 - Exhibition, standardized opium		0.94
U.N. 31 - Exhibition, reduced size cubes		1.15
U.N. 40 - Purchased at Eskiser		1.65

/Turkey (continued)

	Turkey (continued)	
U.N. 41 -	Purchased at Kutahya - ball, A	0.35
	lump, B	1.97
	(Sample A is greatly substandard or adulterated, and assayed only 4.2 percent morphine. In ST/SOA/SER.K/4 the porphyroxine values for U.N. 41A and U.N. 42 were interchanged in error.)	
U.N. 42 -	Purchased at Afyon	1.50
U.N. 44 -	Loaf in copper vessel	1.97
U.N. 46 -	Seizure in France (porphyroxine 4.2)	1.92
	Union of Soviet Socialist Republics	
U.N. 39 -	Sample received from France	1.75
	Vietnam	
U.N. 28 -	Tonkin, Laokay, lump a	1.89
	lump b	1.87
	lump c	2.12
	lump h	2.86
	lump j	2.75
	lump m	3.16
	Yugoslavia	
U.N. 24 -	Yugoslavia No. 1 - Export type	1.16
U.N. 38 -	Yugoslavia No. 2 - small loaf, a	1.19
	small loaf, c	1.46
	small loaf, d	1.20
	small loaf, h	1.48

IV. DISCUSSION OF THE NEW CODEINE DATA

5. In general, the results followed the same pattern found in the previous study (E/CN.7/202). The highest new codeine value found for either Greece or Yugoslavia was 1.46 percent, whereas the lowest new value found for either Iran or India was 2.46 percent, nearly all the new values for Iranian opium and all three new values for Indian opium being, in fact, above 3 percent. The samples of Chinese opium were extremely high in codeine, above 4 percent and two even above 5 percent. This is in accord with the previous finding that samples from the Far East, at any rate from China, Korea, and Mongolia, are the highest of all in codeine.

6. Most Turkish opium is in the low-codeine class, like that of Yugoslavia and Greece. However, some high-codeine opium is produced in Turkey, especially in Malatya and Zile. In the rest of Turkey only a minority of the samples from any one province or district exceed 1.9 percent in codeine (ranging up to 2.65 percent), and these samples moderately high in codeine are not confined to districts producing "soft" opium, but occur also in the "druggist" areas.

/7. Values

7. Values quite close to 2 percent, which were almost missing from the preceding tabulation, are now supplied to some extent by opiums from Indochina (Laos and Vietnam) as well as from Turkey. (See Charts 2 and 3 for the distribution of the values, based on all the data.)

V. REPRESENTATION OF THE CODEINE PERCENTAGES AND PORPHYROXINE VALUES

8. All the charts have the codeine values on the same scale. In all except Chart No. 2 the codeine percentages are used as ordinates; in Chart No. 2 they appear as abscissae. Charts 1 to 3 concern only codeine; Charts 4 to 11 concern both codeine and porphyroxine.

9. On Charts 4 to 11, the Lovibond values of the red colour obtained from the alkaloid "porphyroxine-meconidine" are represented as abscissae. These values are called the porphyroxine values, for short, in this paper. Since most of the samples have porphyroxine values below 30, those showing higher and higher values becoming fewer and fewer, the scale is gradually compressed above this point, at the end the space for values from 50 to 80 being no more than one-fourth that from 0 to 30. The same porphyroxine scale is used on all the Charts 4 to 11.

10. Values previously published are used in all cases with the exception of one redetermination, the codeine percentage of the seizure sample of standardized Indian opium (originally analyzed several years ago, before the method was well established) being raised from 2.25 to 3.02 percent. Samples known to be greatly substandard are omitted from the charts. The few such samples omitted all assay less than 6 percent morphine. Such samples can only be dealt with by means of ratios, not by absolute percentages of the alkaloids. Studies of the ratios will be given later in order that seizures of adulterated and substandard samples may be dealt with. The Zile sample adulterated with cornstarch (U.N. 12A, Turkey) is omitted from the charts distinguishing the Malatya and Zile samples from those of the rest of Turkey, although it is still above 10 percent in morphine.

VI. DISCUSSION OF THE CODEINE CHARTS

Chart No. 1

11. Chart No. 1 shows the curves of codeine percentages in the same way that "porphyroxine-meconidine" values were shown in document ST/SOA/SER.K/4. The codeine percentaces are used as ordinates. Horizontally, the samples for each producing area are in order of the percentage and are spaced equally apart on the curve for that area. The spacing varies for the different areas, being greater for a lesser number of samples.

12. The curve for Afghanistan is not represented chiefly because it would virtually coincide with the curve for India. All the Turkish samples are represented on one curve, but the five highest values (above the mark across the curve) are all from Malatya and Zile. In later charts the samples from Malatya and Zile are

/separated

separated or distinguished from those for the rest of Turkey. The position of the export samples on the curve for Turkey - all on the lower half of the curve - indicates that the high-codeine samples are over-represented in the United Nations samples, if the quantity of production is considered.

13. Although Chart No. 1 does not give the most useful representation of the results for the purpose of determining the origin of seizures, it does bring out certain points, such as the generally slightly higher trend of samples from Iran as compared with those from India. It may also be noted that the lower half of the curve for Turkey will very nearly coincide with the curve for Yugoslavia and Greece (if it be moved over); and this characteristic of the bulk of Turkish production, as shown by the position of the export samples on the Turkish curve.

14. The greatest gap between the median values is between the curve for Laos and Vietnam and the curve for India. A line at 2.4 percent will divide the curves rather well into two main families, with little overlapping, except for the intermediate character of the curve for Laos and Vietnam.

Chart No. 2

15. The style of representation in Chart No. 2 is the same as that used for the chart in document E/NC.7/202. The codeine values are the abscissae, but are taken only to the nearest 0.1 percent; the ordinates for each curve represent the number of samples found at that percentage.

16. The groups are more obvious on the chart than if explained in words. The effect of dividing lines at 1.6, 2.0, and 2.7 percent may be noted.

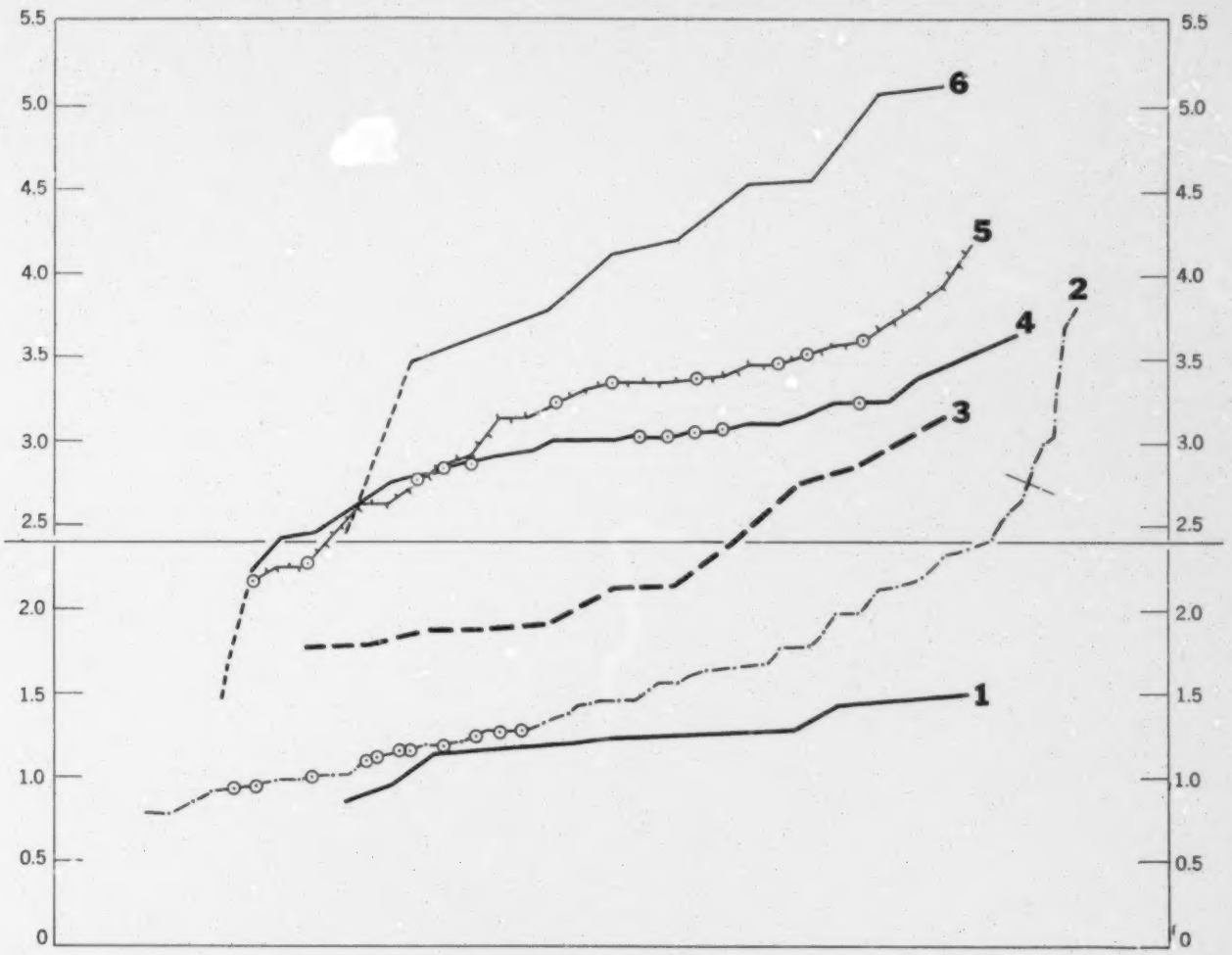
Chart No. 3

17. In Chart No. 3 the codeine values are ordinates and are entered at the exact value analytically determined, as close as can be, without overlapping of the spots, to the vertical line for each area.

18. This is the most useful way of representing the codeine values for the purpose of noting the probable origin of an opium seizure as indicated by its codeine percentage. Boundary lines may be taken for greatest convenience and with sufficient accuracy at 0.5, 1.33, 2.0, 3.0, 3.5, 4.0, 4.5, and 5.5 percent as indicated on the chart.

CHART NO. 1

CURVES OF CODEINE PERCENTAGES FOR SIX OPIUM-PRODUCING REGIONS



KEY: 1. Greece and Yugoslavia (16 samples)
2. Turkey (85 samples)
3. Laos and Vietnam (11 samples)
4. India (29 samples)
5. Iran (27 samples)
6. China, Korea, Mongolia (10 samples)

Ordinates are the percentages of codeine.

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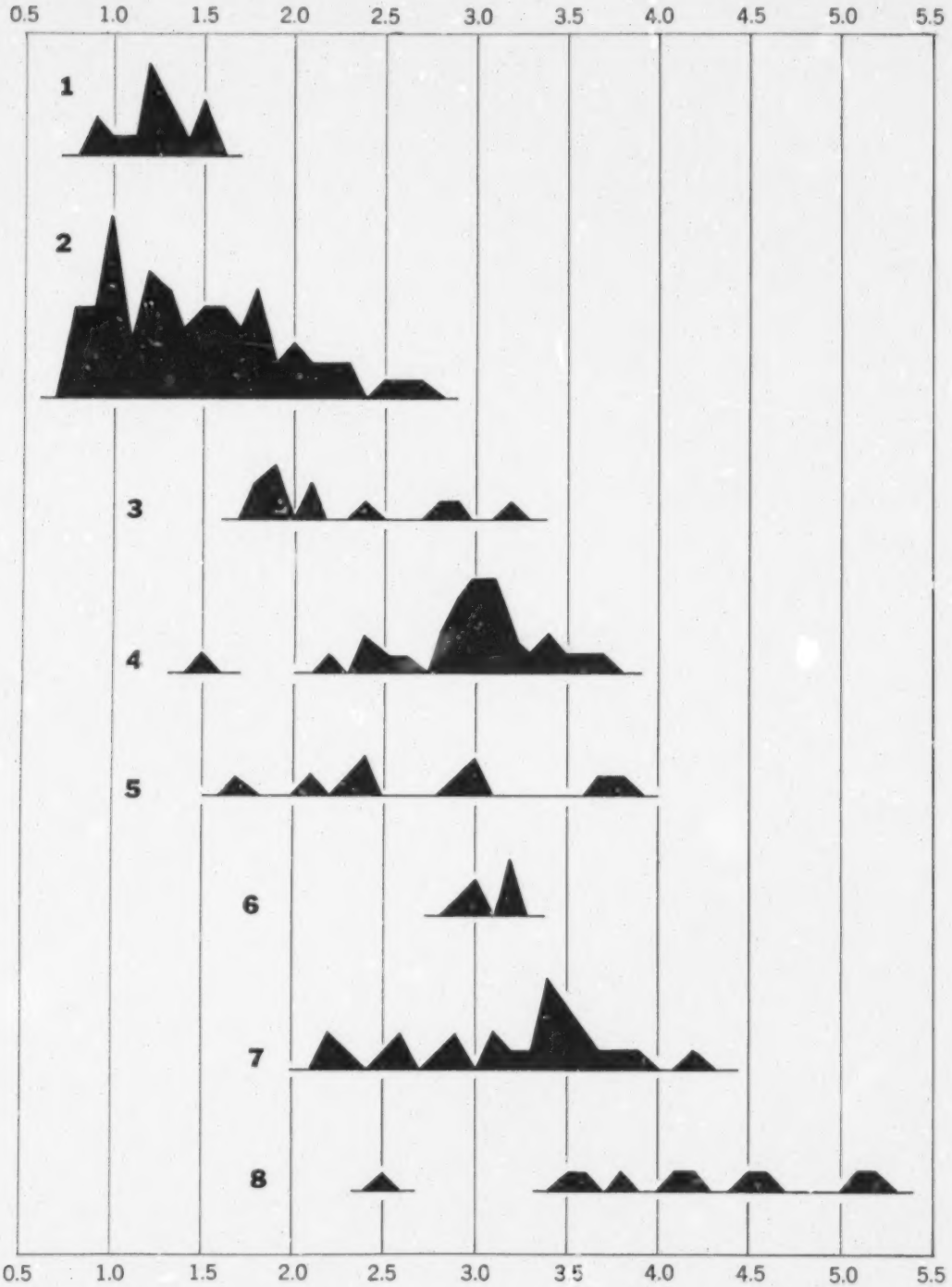
CHART NO. 2

DISTRIBUTION OF THE CODEINE GROUPS FOR EIGHT OPIUM-PRODUCING REGIONS



KEY:
1. Greece and Yugoslavia
2. Turkey, excluding Malatya and Zile
3. Laos and Vietnam
4. India
5. Turkey, Malatya and Zile only
6. Afghanistan
7. Iran
8. China, Korea, Mongolia

Abscissal are the codeine percentages (taken to the nearest tenth).

Ordinates for each curve separately are the number of samples at the particular percentage.

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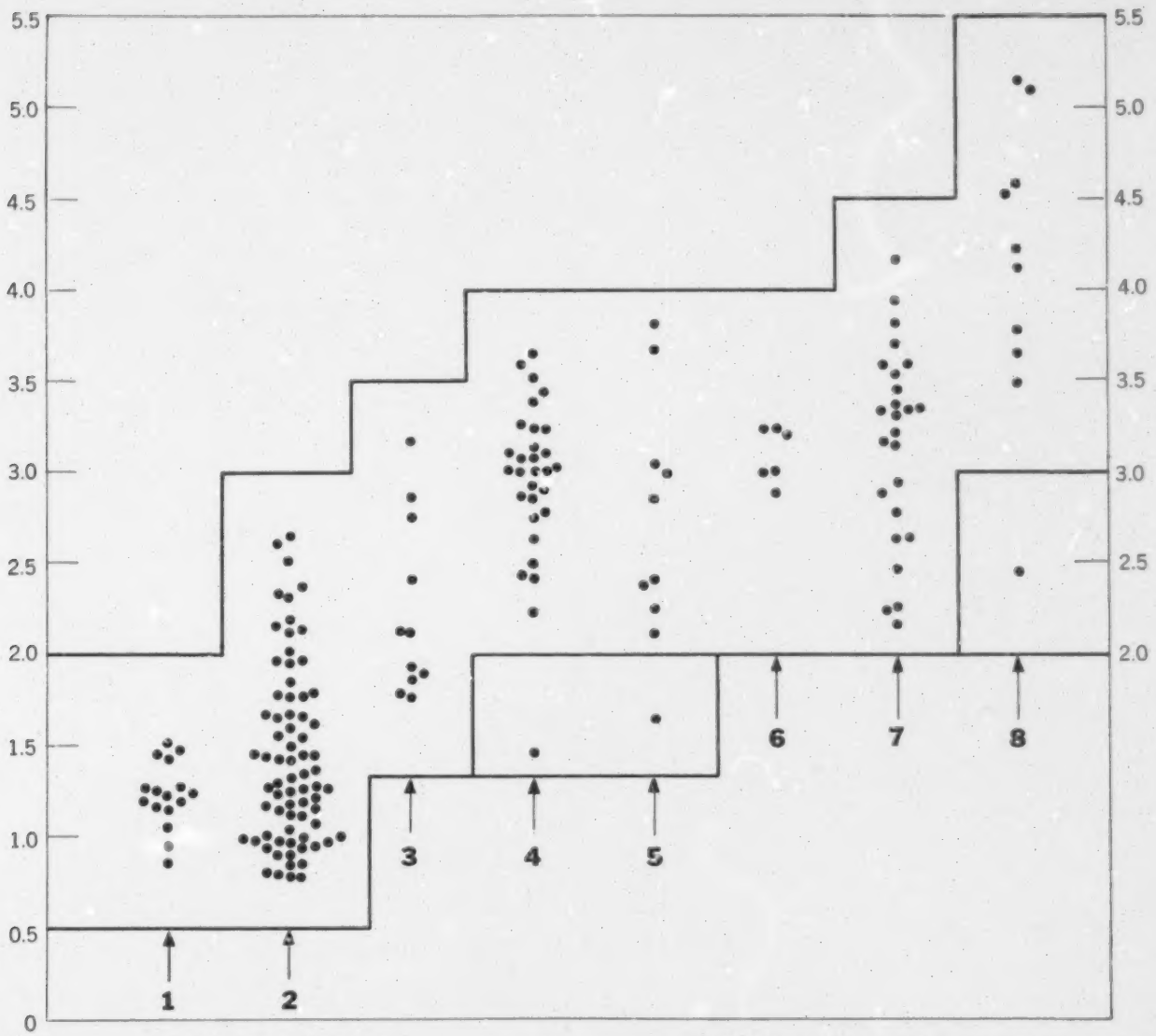
CHART NO. 3

DISTRIBUTION OF THE CODEINE PERCENTAGES OF OPIUM FOR EIGHT PRODUCING REGIONS



KEY:
1. Greece and Yugoslavia
2. Turkey, excluding Malatya and Zile
3. Laos and Vietnam
4. India
5. Turkey, Malatya and Zile only
6. Afghanistan
7. Iran
8. China, Korea, Mongolia

Ordinates are the codeine percentages.

For each sample a spot is placed at the correct height for the codeine percentage according to the laboratory determination, and as close as possible, without overlapping, to the vertical line for the particular region.

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KEY FOR CHARTS N° 4 TO N° 11

KEY:

AFGHANISTAN

△ CHINA, KOREA and MONGOLIA

○ GREECE

\+ INDIA

● IRAN

▽ LAOS and VIETNAM

○ TURKEY excluding MALATYA and ZILE

⊗ TURKEY, MALATYA and ZILE only

▲ YUGOSLAVIA

Ordinates: Codeine percentages

Abscissal: Porphyroxine values

KEY FOR CHARTS N° 4 TO N° 11

KEY:

AFGHANISTAN

△ CHINA, KOREA and MONGOLIA

○ GREECE

\+ INDIA

● IRAN

▽ LAOS and VIETNAM

○ TURKEY excluding MALATYA and ZILE

⊗ TURKEY, MALATYA and ZILE only

▲ YUGOSLAVIA

Ordinates: Codeine percentages

Abscissal: Porphyroxine values

VII. DISCUSSION OF CHARTS 4 TO 10

Chart No. 4

19. Chart No. 4 shows the position of the export samples of India, Iran, Turkey, and Yugoslavia, plotted for codeine percentage and porhyroxine value. Three quite distinct areas are indicated, the export samples of Turkey and Yugoslavia occupying virtually the same area.

Charts No. 5, 6, 7 and 8

20. Charts No. 5, 6, 7 and 8 show the codeine-porhyroxine positions for all the samples (except a very few which were found adulterated or greatly substandard) from four main producing regions: Chart No. 5, the Far East (China, Korea, Mongolia); No. 6, India; No. 7, Iran; and No. 8, Turkey. By superimposing one of these charts upon another the extent to which the areas of the chart overlap one another can be easily seen. The overlapping is not very great: the majority of the samples of one region always fall outside the area charted for any one of the other three regions.

Chart No. 8

21. On Chart No. 8 it will be noted that the area characteristic of samples from Malatya and Zile is quite separate from the area for the rest of the Turkish samples. The samples from Malatya and Zile do not form as compact a group as the samples from other regions; still, 7 out of 10 of these samples fall in the characteristic area of fairly high codeine percentage and extremely high porphyroxine value. These samples represent a unique type of opium, which quite possibly may be produced to some extent in some other parts of Turkey, though not otherwise represented among the available Turkish samples. Conversely, some of the "normal" Turkish opium may be produced on some farms in the Malatya and Zile districts.

Charts No. 9 and 10

22. Chart No. 9 shows on one chart the areas for samples from Afghanistan, Indochina (Laos and Vietnam), and Greece and Yugoslavia. (The opium-producing areas for both Greece and Yugoslavia, and Bulgaria as well, are in Macedonia.) These areas can be drawn without overlapping each other, except that one Indochina sample is "out of place". Of course, these areas overlap some of those shown in Charts 5 to 8.

23. Chart No. 10 shows on one chart all the samples shown on Charts 5 to 8. Chart No. 10 shows the very great degree to which the five areas can be drawn without substantial overlapping and with very few samples represented in the wrong area. Of course, the boundaries are somewhat arbitrary, and if more samples were examined the overlapping would probably increase, but the clustering of samples would also increase, doubtless even more conspicuously.

24. If Chart No. 9 is superimposed on Chart No. 10, it will be seen that most of the samples from Afghanistan correspond to the higher-porphyroxine samples from Iran; most of those from Laos and Vietnam correspond to the higher-codeine samples of Turkey (without Malatya and Zile); and the samples from Greece and Yugoslavia correspond to

/the area

the area of greatest clustering of the samples from Turkey. (The Afghan samples may also be compared to the low-porphyroxine samples of India as shown on Chart No. 6.)

VIII. USE OF THE CHARTS WITH SEIZURE SAMPLES

25. If the coordinates (codeine percentage and porphyroxine value) of a sample of seized opium are noted on Chart No. 10, they usually show clearly the geographical region from which the opium probably came, or at least, greatly limit the possibilities. Of course, other regions, such as those represented on Chart No. 9, sometimes have to be taken into consideration also.

26. When the position for a seizure sample does not correspond to an area where the characteristic samples cluster, but rather is on or near a boundary line, or where areas may overlap, and when a decision must be made between such corresponding areas as are mentioned in paragraph 24, it is obvious that one or more characteristics in addition to codeine percentage and porphyroxine value must be used. However, aside from rare instances of very abnormal opium, the codeine-porphyroxine charts always limit the possibilities for any particular sample to a very few regions, and in addition show what kind of samples from those regions should be taken for further comparisons.

27. Chart No. 11 shows the allocation of 15 seizure samples to three different regions of production. Although in the case of most of these samples there was other evidence of the origin, it surely would not be hard to decide the probable origin upon purely chemical grounds.

CHART NO. 4

CODEINE - PORPHYROXINE VALUES FOR SAMPLES OF EXPORT OPIUM FROM INDIA, IRAN, TURKEY AND YUGOSLAVIA

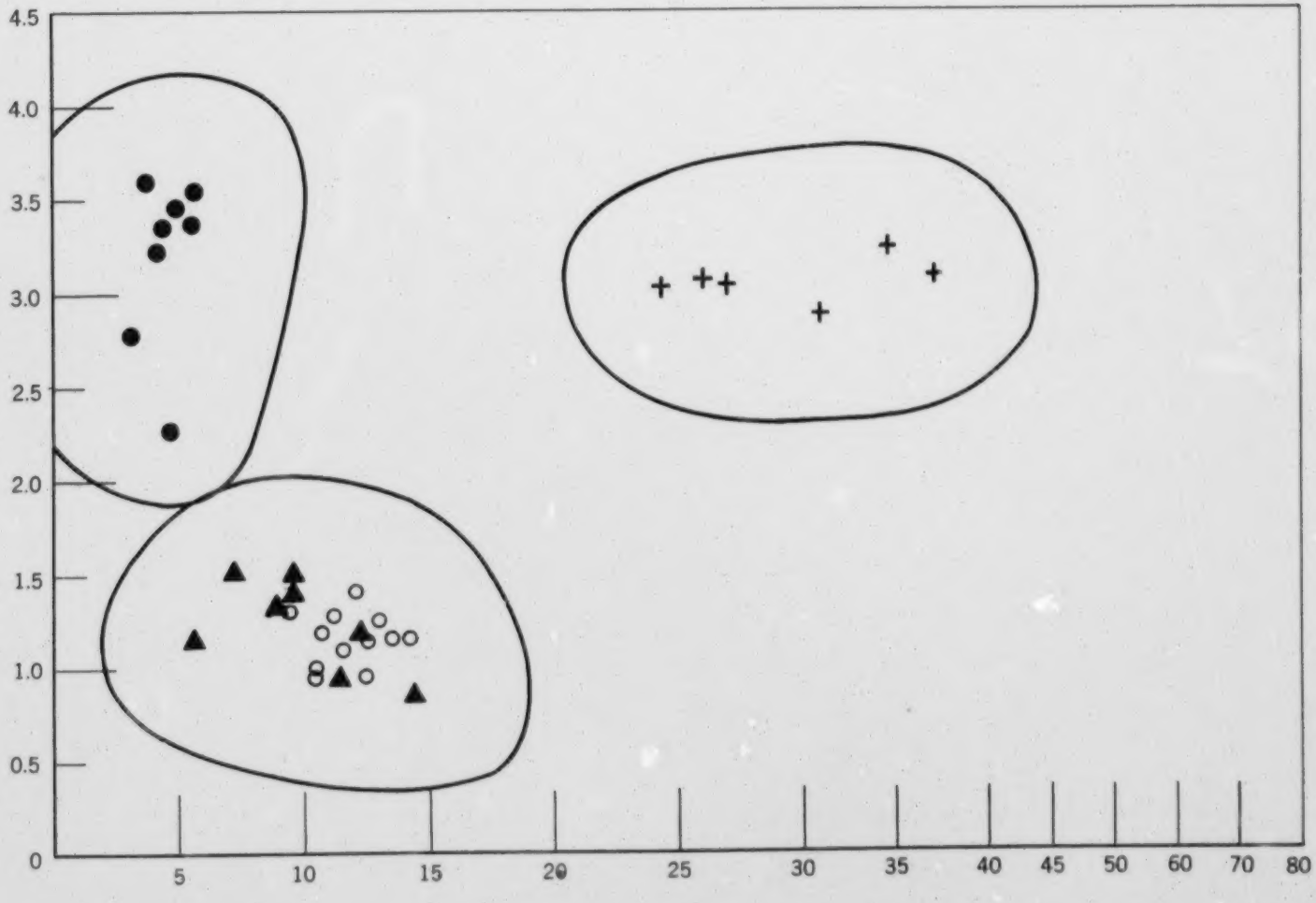

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CHART NO.5

CODEINE - PORPHYROXINE VALUES FOR OPIUM SAMPLES FROM CHINA, KOREA, MONGOLIA

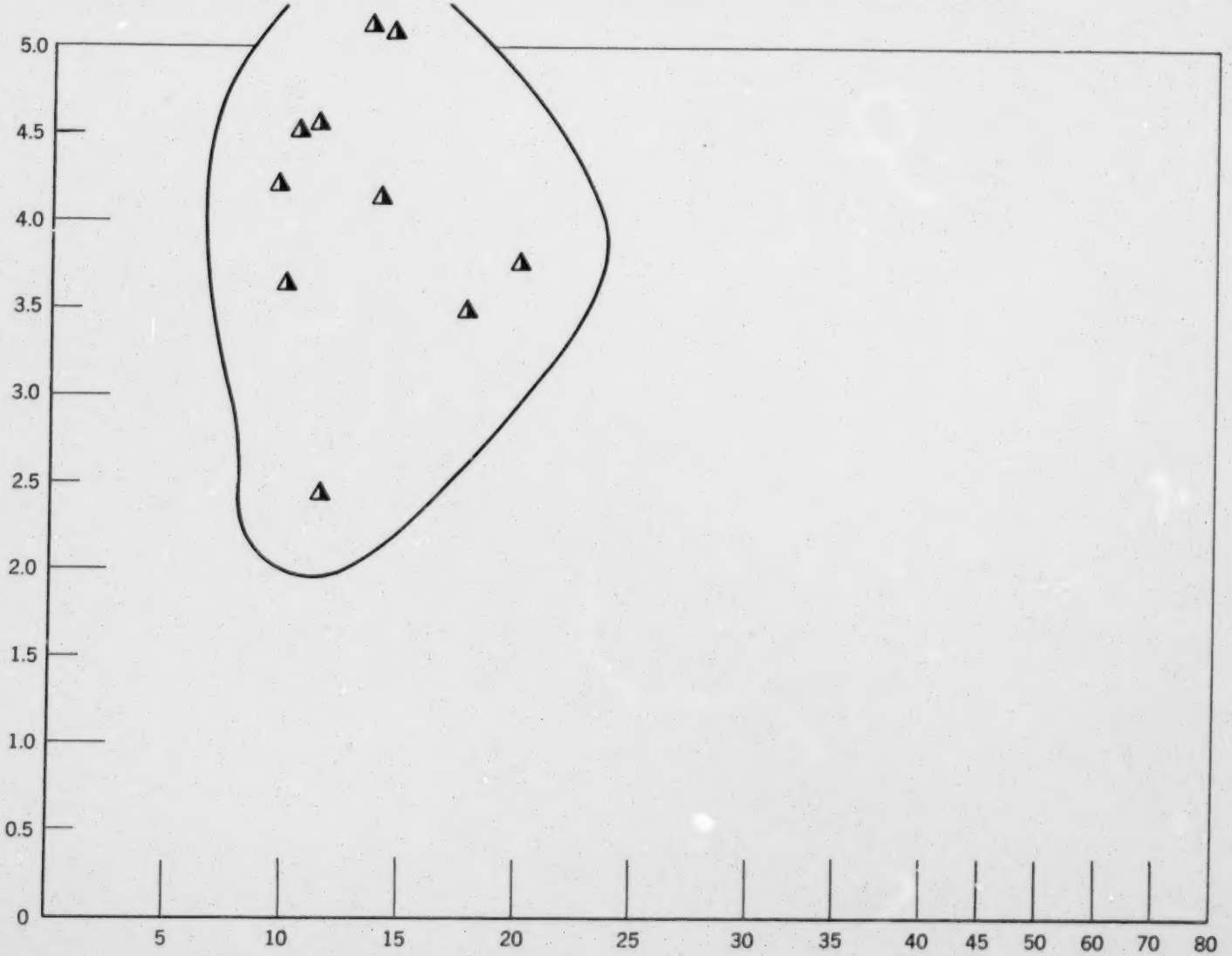

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CHART NO.6

CODEINE - PORPHYROXINE VALUES FOR OPIUM SAMPLES FROM INDIA

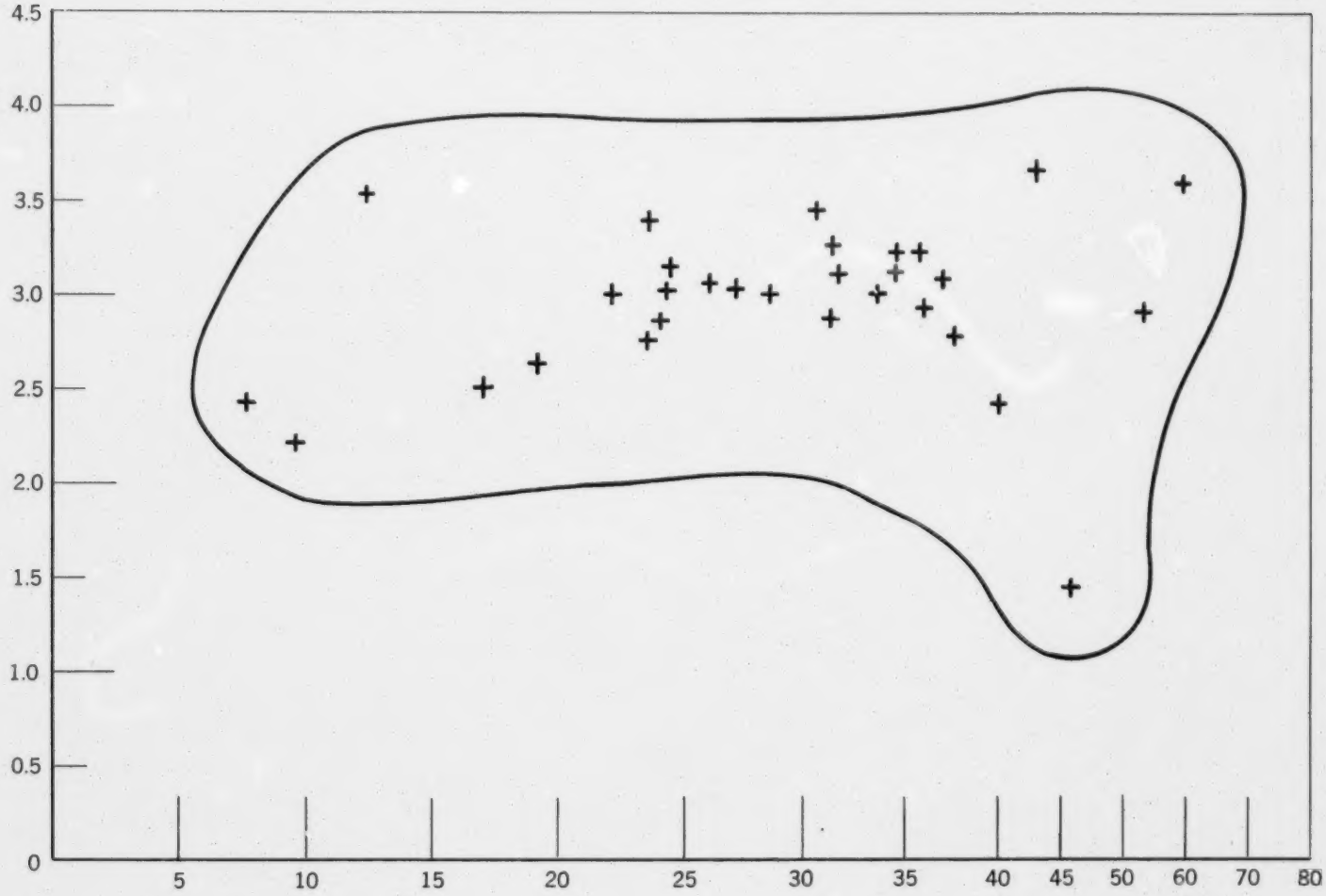

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CHART NO. 7

CODEINE - PORPHYROXINE VALUES FOR OPIUM SAMPLES FROM IRAN

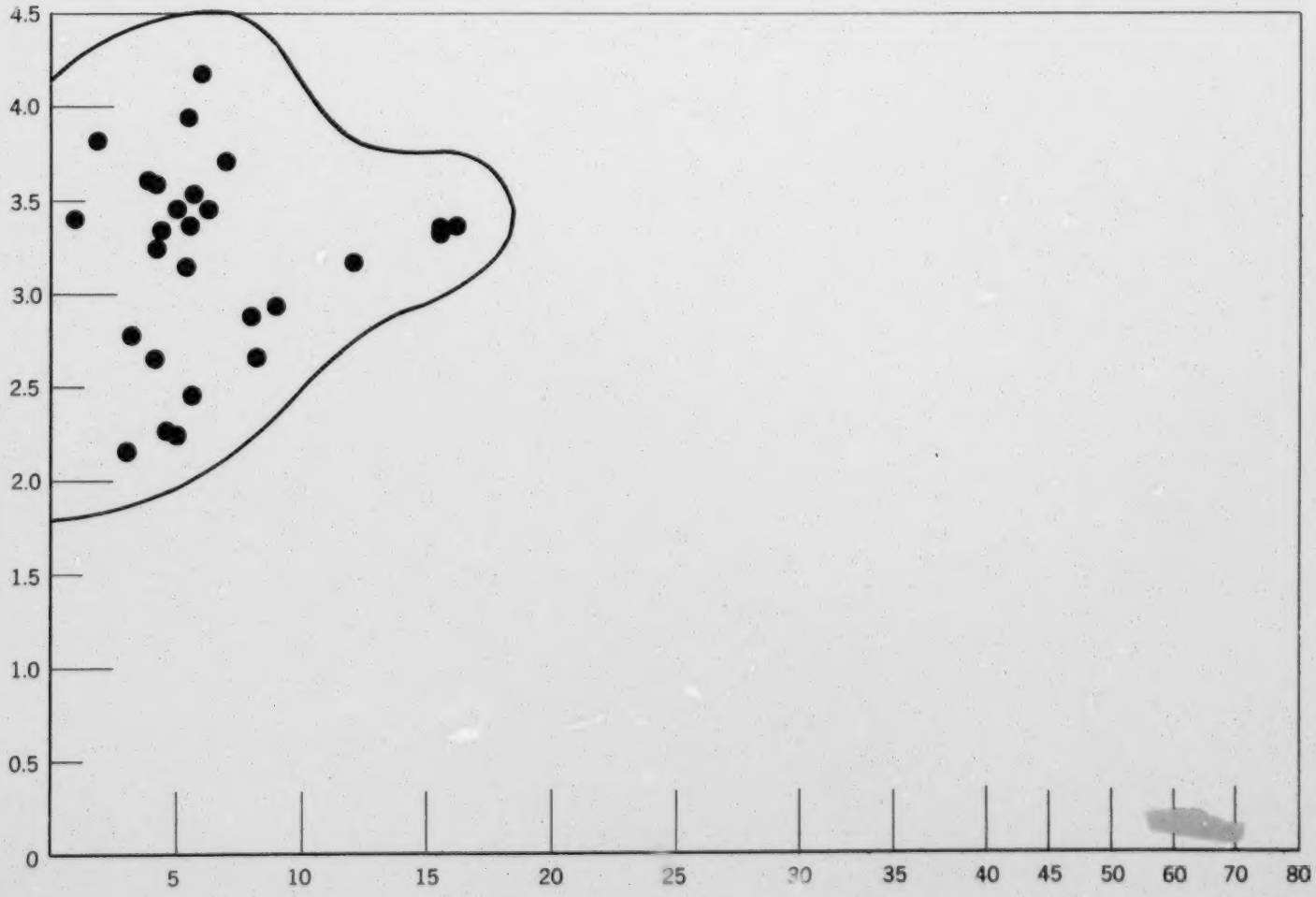

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CHART NO. 8

CODEINE - PORPHYROXINE VALUES FOR OPIUM SAMPLES FROM TURKEY

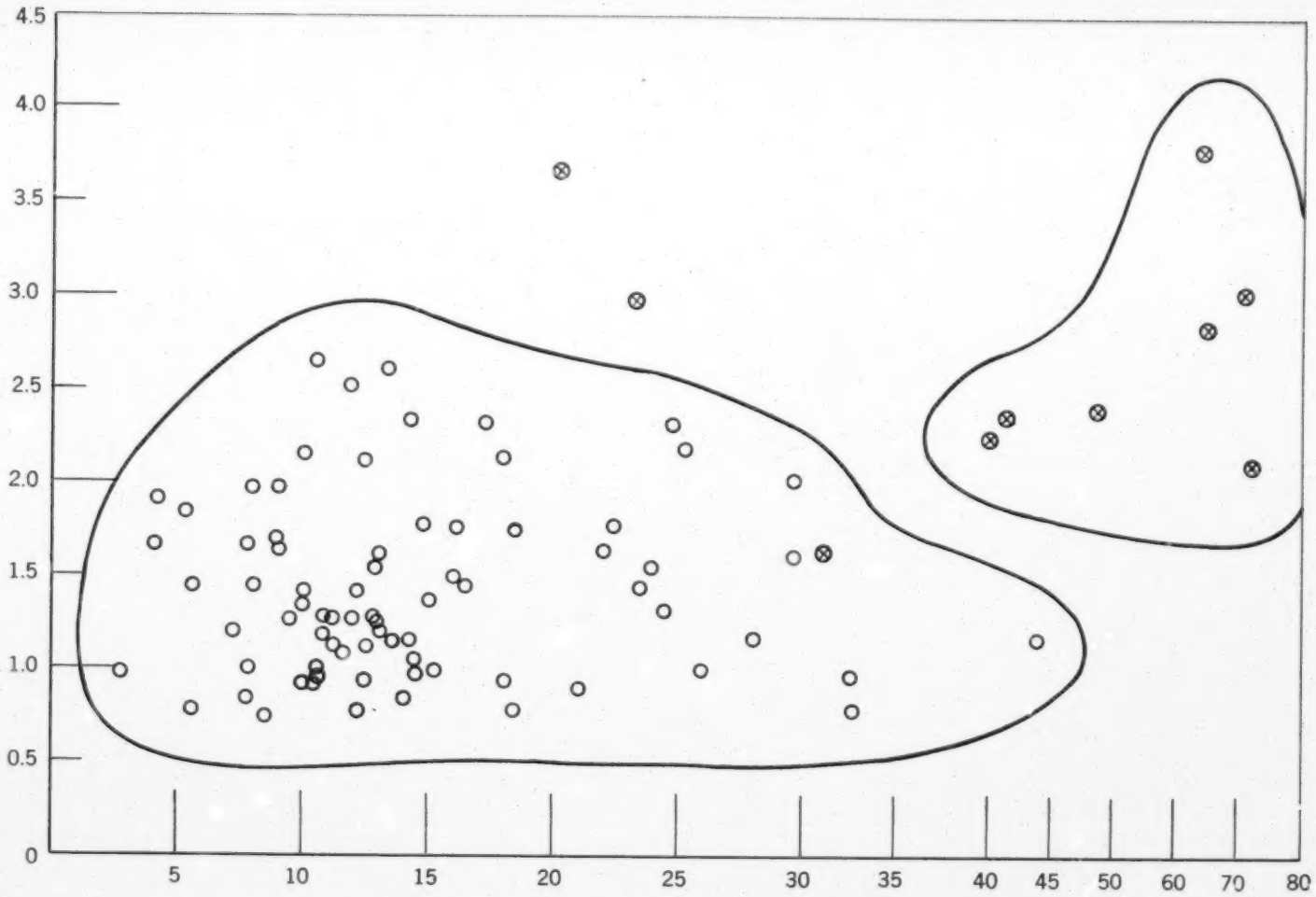

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CHART NO. 9

CODEINE - PORPHYROXINE VALUES FOR OPIUM SAMPLES FROM THREE PRODUCING REGIONS: AFGHANISTAN, LAOS AND VIETNAM, YUGOSLAVIA AND GREECE

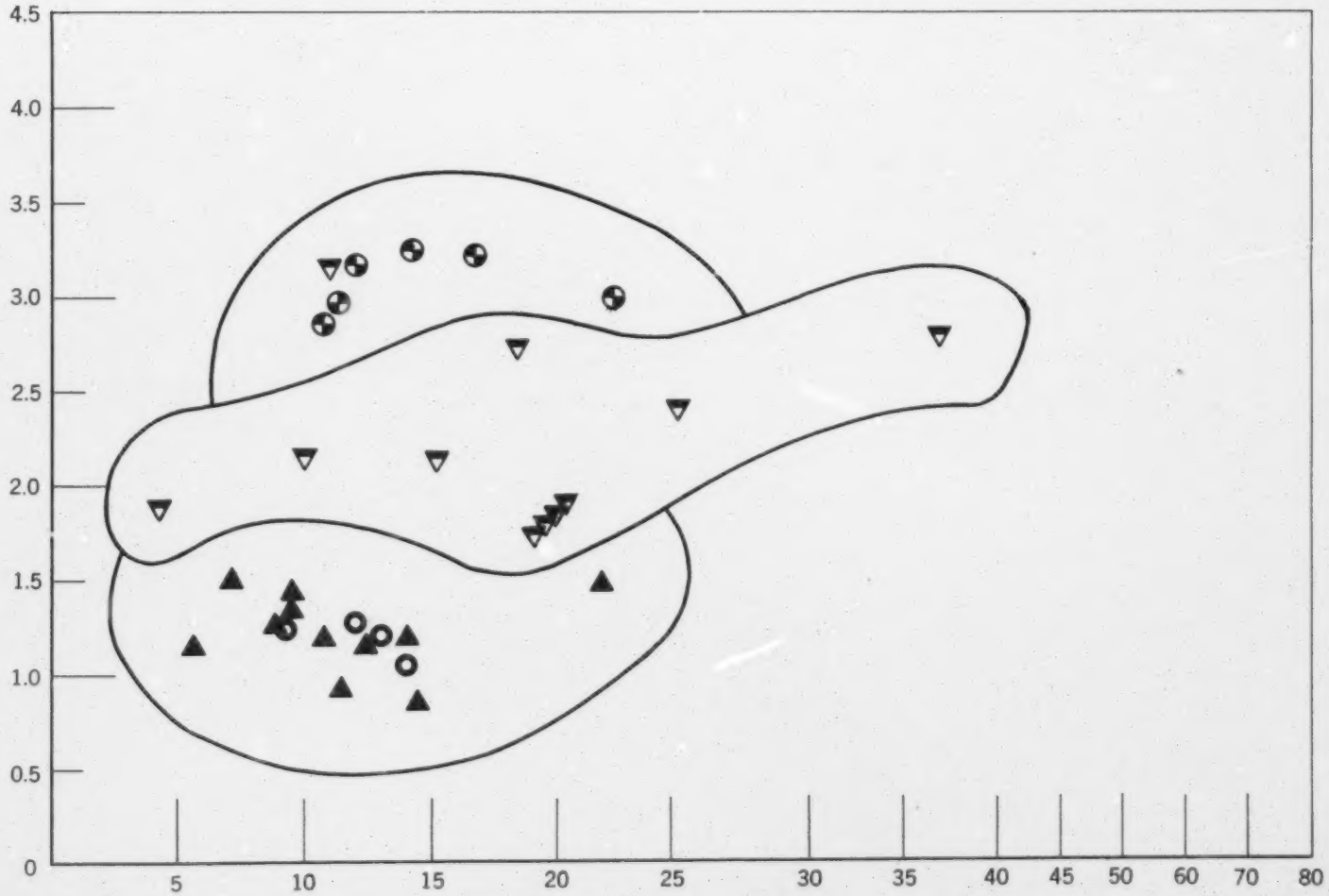

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CHART NO. 10

CODEINE - PORPHYROXINE VALUES FOR OPIUM SAMPLES FROM FIVE MAIN PRODUCING REGIONS:
CHINA, KOREA, MONGOLIA; INDIA; IRAN; TURKEY, EXCLUDING ZILE AND MALATYA; TURKEY, ZILE AND MALATYA ONLY

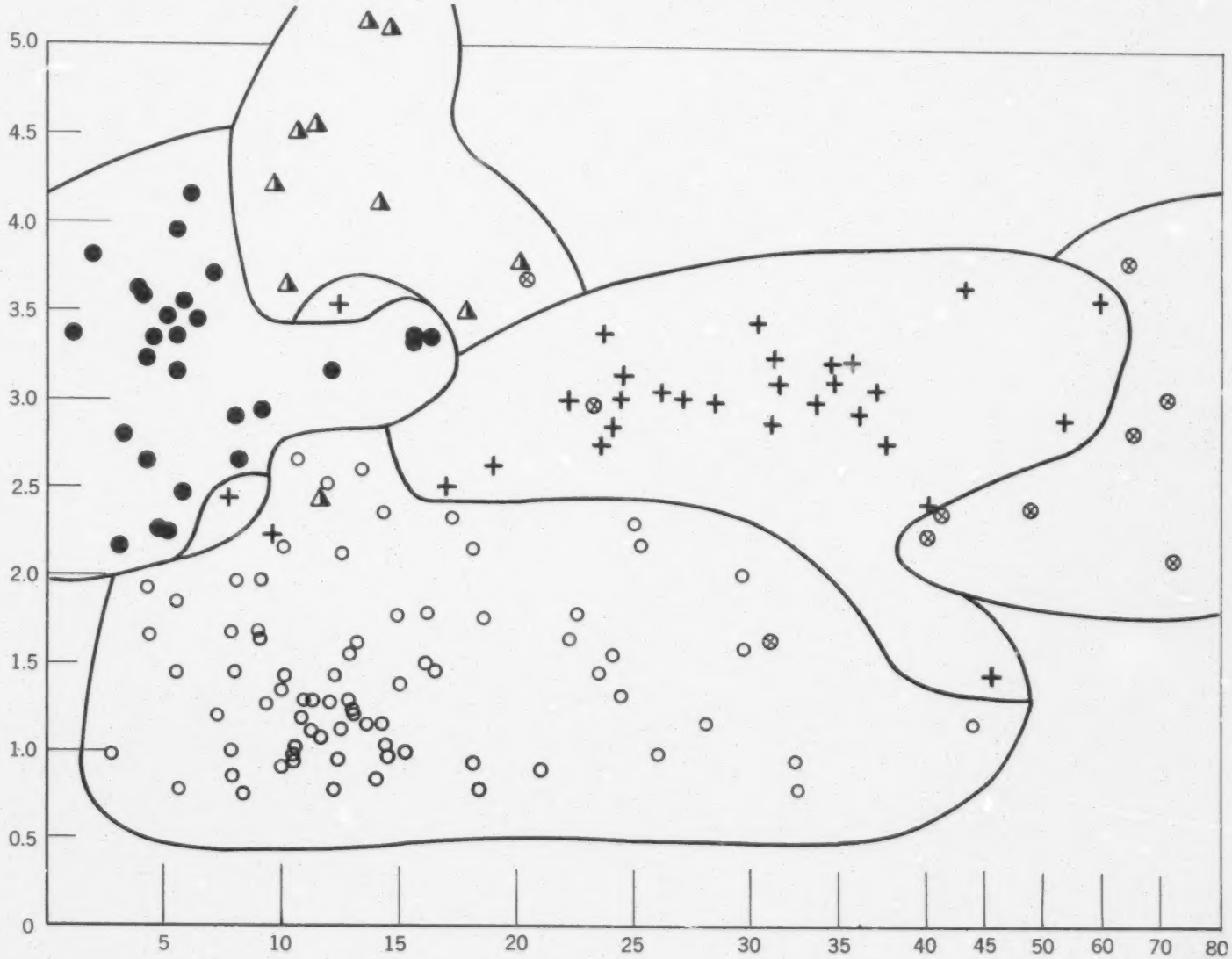

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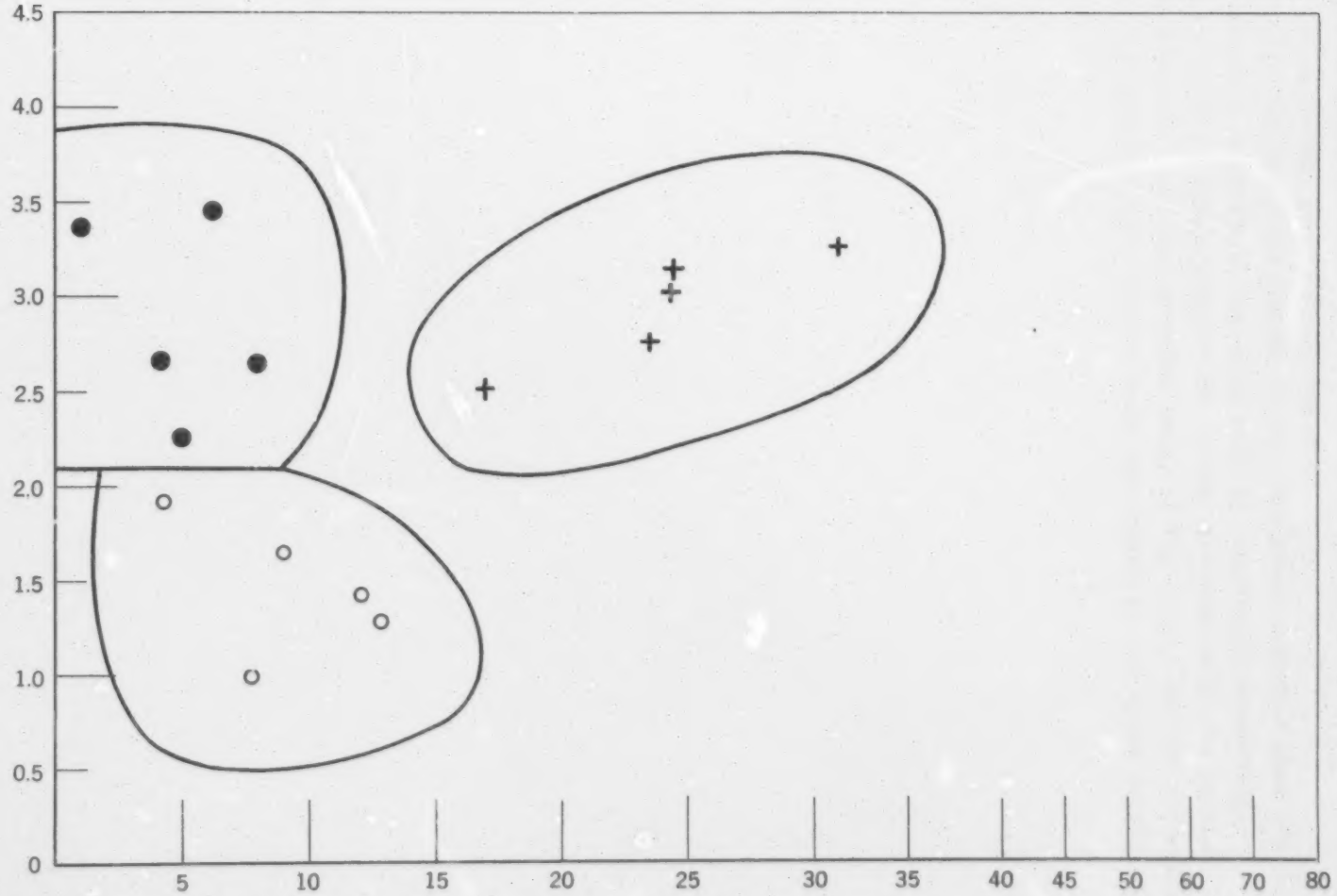
CHART NO. 11

CODEINE - PORPHYROXINE VALUES FOR FIFTEEN SAMPLES OF SEIZURES OF OPIUM



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IX. CONCLUSIONS

28. The codeine values fall in fairly well-defined groups, which in the main correspond to the different geograph cal regions.

29. The codeine and the porphyroxine values considered together show the origin of the opium much more definitely than when each is considered separately.

30. The correlated codeine-porphyroxine values, together with the general appearance, microscopic test, and morphine assay of the opium, and the circumstances attendant upon the seizure, will usually make the origin of the opium fairly obvious.

- - - - -